PROCEEDINGS

OF

THE ROYAL SOCIETY.

1846. No. 65.

May 7, 1846.

The MARQUIS OF NORTHAMPTON, President, in the Chair.

W. G. Armstrong, Esq., was elected a Fellow of the Society.

"On the Anatomy and Physiology of the Vascular Fringes in Joints, and the Sheaths of Tendons." By George Rainey, Esq., M.R.C.S. Communicated by John Simon, Esq., F.R.S., Assistant-Surgeon to the King's College Hospital, and Demonstrator of Anatomy in King's College, London.

It has been generally believed that the folds of synovial membrane which project into the articular cavities in the form of fringes, contain merely globules of fat, and are subservient only to the mechanical offices of filling up spaces that would otherwise be left vacant during the movements of the joints. By a careful examination of their real structure with the aid of the microscope, the author has found that they present an arrangement of vessels quite peculiar to themselves, and bearing no resemblance whatever to that of the vessels which secrete fat; together with an epithelium, remarkable by its form and disposition, and characteristic of organs endowed with the function of a special secretion. He has traced the presence of these synovial fringes in all cavities which contain synovia; that is to say, not only in the joints, but also in the sheaths of tendons, and in the bursæ mucosæ. When well-injected, they are seen, under the microscope, to consist of two parts; namely, a convolution of blood-vessels, and an investing epithelium. These convoluted vessels do not enclose, by their anastomoses, spaces like those capillaries which secrete fat, and which are of a much smaller size than the former; and the epithelial investments, besides enclosing separately each packet of convoluted vessels, sends off from each tubular sheath secondary processes of various shapes, into which no blood-vessels enter. The lamina itself, forming these folds and processes, consists of a very thin membrane studded with flattish oval cells, a little larger than blood-corpuscles, but destitute of nucleus or nucleoli; presenting none of the characters of tessellated epithelium, but corresponding more to what Mr. Goodsir has termed *germinal membrane*. From all these facts the author concludes that the proper office of this structure is to secrete synovia; an office which Clopton Havers had assigned to them as long ago as the year 1691, although his opinion has not been generally adopted by later physiologists.

"Description of a Process for extracting the Palladium which exists in combination with the Gold of the Gongosocho and other Mines in the Brazils." By Percival N. Johnson, Esq., in a letter to the President, by whom it is communicated to the Society.

The process consists in melting the gold, obtained from its matrix by the ordinary processes of stamping and washing, with three times its weight of silver, granulating it in cold water, and refining it by the process of quartation, or separation of its alloys by nitric acid. The nitric solution contains the silver, palladium, copper, and a small proportion of iron and lead.

May 14, 1846.

The MARQUIS OF NORTHAMPTON, President, in the Chair.

Contributions to Terrestrial Magnetism. No. VII. By Lieut.-Colonel Sabine, R.A., For. Sec. R.S.

From the discovery which was made of the non-coincidence of the locality of the maximum magnetic intensity, within the Arctic circle, with that in which the magnetic direction is vertical, it followed that the generally prevailing opinions respecting the distribution of magnetic force at the surface of the earth were erroneous, and that even the broad outline of the picture of terrestrial magnetism required to be recast. For the purpose of obtaining sufficiently copious and accurate materials, by means of which so desirable an object could be accomplished, the British Association for the Advancement of Science requested, in the year 1835, a report to be prepared, in which the state of our knowledge, collected from a great variety of sources, with regard to the variations of the magnetic force at different parts of the earth's surface, should be reviewed, and properly discussed, and suggestions offered as to the best means of extending the inquiry. In the report so obtained, it was recommended that magnetic surveys of that portion of the North American Continent, which is comprised within certain isodynamic lines, should be procured. The present paper contains the results of an expedition towards the accomplishment of this object, recommended by the President and Council of the Royal Society to be undertaken under the auspices and with the assistance of the Hudson's Bay Company. Lieutenant Lefroy, of the Royal Artillery, who had received an appointment to the Toronto Observatory, with a special view to this survey, was entrusted with the conduct of an expedition in conformity with that recommendation.

The author gives a circumstantial narrative of the expedition, together with minute details of the instruments employed, and the methods of observation adopted; and extensive tables of the observations themselves, both as regards intensity and inclination, at the different stations where they were made, occupying altogether about 120 folio pages of manuscript.

It results from the calculations founded on the data furnished by these observations, that the geographical position of the point of maximum intensity, where its amount is 1·88, is 52° 19′·3 north latitude, and 268° 01· longitude. The angle which the major axis of the ellipse makes with the parallel of geographical latitude is 57° 49′·5; and the values of the semi-axes of the ellipse of 1·875 are 290 and 110 geographical miles respectively.

May 28, 1846.

The MARQUIS OF NORTHAMPTON, President, in the Chair.

"An Account of the desquamation and change of colour in a Negro of Upper Guinea, West Africa." By the Rev. Thomas S. Savage, M.D., Corr. Member of the Boston Natural History Society, &c. Communicated by Richard Owen, Esq., F.R.S.

The subject of this narrative, named Tahtoo Duari, is a member of the Grebo tribe, the aboriginal inhabitants of Cape Palmas and its vicinity. His parents were members of the same tribe and natives of the same region. The father was of a decidedly black complexion, while the mother was what is termed *yellow*, the two extremes observable in the tribe, and between which there is found every variety of shade. In March 1844, when about twenty-five years of age, Tahtoo was attacked with a quotidian ague, having previously been in perfect health. The febrile symptoms subsided in the course of a week, but were followed by a general desquamation of the cuticle, leaving the subjacent skin of a dingy yellow hue. A month afterwards, the same process, preceded by a similar febrile attack, recurred, and was followed by still greater whiteness of the newly-formed skin, resulting in the complete conversion of a negro to a white man, retaining the characteristic features and hair of an Ethiopian. This change was accompanied with great sensibility in the skin to the heat of the sun and of fire, exposure to which readily excited irritation, and even inflammation; but the general health soon became completely re-established. In the course of three months, subsequently to this change, numerous spots of a chestnut-brown colour made their appearance, first on the wrists, then on the back of the arms, head and neck, and successively on the other parts of the body, forming by their extension dark patches of various sizes; which, being scattered over the whole surface, presented a singularly mottled appearance; and as the black colour became predominant, the white portions of the skin seemed like patches of irregular shape formed in the natural negro skin. With the colour of the skin, that of the hair, which had also become white, has been gradually restored to its former black hue. During this process of return to the natural colour the health has been remarkably good.

June 11, 1846.

The MARQUIS OF NORTHAMPTON, President, in the Chair.

"On the Physiology of the Human Voice." By John Bishop, Esq., F.R.S.

After premising a brief description of the system of organs which are subservient to the voice, the author proceeds to consider the several theories which have been devised to account for its various modifications. These theories have, for the most part, been founded on the laws which regulate the vibratory movements of stretched membranous surfaces; and the investigation of those laws has accordingly occupied the attention of many eminent mathematicians, such as Euler, Bernoulli, Riccati, Biot, Poisson and Herschel; but it is a subject requiring the most profound analysis, and involving the resolution of problems of much greater complexity than the laws of the vibrations of either strings or bars. The assumptions which are necessary in order to bring the subject within the reach of analysis, namely, that the membrane is homogeneous in its substance, and of equal thickness and elasticity throughout its whole extent, are at variance with the actual conditions of the vocal organs, which are composed of tissues differing in thickness, density and elasticity, and of which the tension is indeterminate; circumstances which present insuperable obstacles to the attainment of a mathematical theory of their vibrations.

The author, after giving a critical account of the experiments made by Biot, Willis, Müller, Cagniard la Tour and De Kempelin on the vibrations of membranous laminæ, examines the various actions of the vocal organs during the production of the more simple tones; and considers more especially the office of the vocal ligaments, in regulating the pitch of the voice, which he considers as resulting from variations in their length and tension conjointly. By applying to the chordæ vocales the formulæ of vibrating cords, he traces the influence which is exerted on their movements by the mucous membranes; and finds that they obey, to a certain extent, the laws of vibrating strings.

The analogy between the action of the glottis and that of a reed is next examined, and an opinion expressed that the movements of the glottis in the vocalization of the sound, partake of the nature of the reed, during the partial opening and shutting of the rima-glottidis.

The author next investigates the acoustic relations between the actions of the glottis and that of the vocal pipe, and the acoustic effects of flexible membranous tubes on a column of air vibrating within it, and finds that the structure of the trachea and of the soft parts above and below the larynx is adapted to vibrate synchronously with any note that may be formed in the larynx. The falsetto voice may be produced either by the partial closing of the glottis, or by a nodal division of the vocal chords; the pitch of the sound in the production of this peculiar modification of the voice, being such that the column of air in the vocal tube is of the precise length requisite to vibrate in unison with the larynx. The inquiry is further extended to the sources of the various tones of the voice in singing, such as the *bass*, *tenor*, *contralto*, and *soprano*; together with their subdivisions of *barytone*, *mezzo-soprano*, and *soprano-sfogato*; and to the places which they occupy in the musical scale. Independently of the falsetto, the compass of the natural voice rarely exceeds two octaves; although in some cases, as in those of Malibran and Catalani, it may extend even beyond three. The voice in singing is modulated by the contraction or relaxation of the velum, uvula and fauces. The author lastly adverts to the attempts that have, at various times, been made by the Abbé Mical, Faber, Kratzenstein, De Kempelin, Willis, Wheatstone and others, to imitate articulate sounds by mechanism.

Having thus examined the human voice as resulting from the vibration of membranous ligaments, in obedience, first, to the laws of musical strings; secondly, to those of reeded instruments; and thirdly, to those of membranous pipes; he arrives at the conclusion, that the vocal organs combine, in reality, the actions of each of these instruments, and exhibit in conjunction, the perfect type of every one of them.

June 18, 1846.

The MARQUIS OF NORTHAMPTON, President, in the Chair.

"The Electric Fluid." By W. F. Stevenson, Esq., F.R.S.

The author denies the existence of two electric fluids, and maintains that all the phenomena are explicable on the hypothesis of a single fluid; which when present in a conducting body renders it positive, and in a non-conducting body, negative; but a body which is naturally a conductor, may, he asserts, be rendered otherwise, by changing its form.

"Observations of the Heights of the Thermometer and Barometer made at Lenham Lodge, near Maidstone, Kent, during the first nine days of the month of June 1846." By George Hunsley Fielding, M.D., F.R.S.

On Sunday the 7th of June 1846, the thermometer in the shade rose to the extraordinary height of 94° Fahr., exceeding by one degree the heat of the 13th of July 1808, which was considered to be the highest on record in this country.

"On the relative dynamic value of the Degrees of the Compass; and on the Cause of the Needle resting in the Magnetic Meridian." By Sir Graves C. Haughton, K.H., M.A., F.R.S., Foreign Associate of the Institute of France.

By ascertaining the distances at different azimuths at which a bar magnet placed with its axis directed to the centre of a magnetic compass needle caused the needle to assume the position in which its axis was in the same line with that of the magnet, the author found that these points of distance form a peculiar curve, which was nearest to the centre of the magnet at the east and west azimuths, and receded from it as it advanced to the north and south; and was twice the distance from it at the north than at the south azimuths. From this and other experiments he infers that the value of every degree of the compass is inversely as the square of the length of the ordinate or co-ordinate passing through it, the abscissa being considered as zero; and that the magnetic needle does not rest in the magnetic meridian in consequence of polar attraction, but is impelled in that direction by the effect of repulsion, from the east or west, and that its natural position is the result of an equilibrium between the eastern and western repulsions. On the other hand, the return of the needle, when it is placed in the reverse position, that is, when made to deviate 180° from its natural position, is the result of an attraction towards the east and west positions; the force of attraction in that case being quadruple the force of repulsion in the former case. He is consequently led to the conclusion that the operation of terrestrial magnetism is totally different from that of an artificial magnet, in which latter case the attractive and repulsive forces are exactly equal.

"Remarks on the Extractive Material of Urine, and on the Excretion of Sulphur and Phosphorus by the Kidneys in an unoxidized state." By Edmund Ronalds, Ph.D., Giessen. Communicated by Golding Bird, M.D., F.R.S.

In the course of an experimental inquiry in which the author was engaged with a view to ascertain whether larger quantities of carbon were discharged by the kidneys in cases in which the functions of the lungs or liver were imperfectly performed, he was led to the result, that sulphur, not combined with oxygen in the form of sulphuric acid, existed in the urine to the amount of from three to five grains in the course of a day; and also that phosphorus, not in the state of phosphate, was in the same period excreted by the same channel, to the extent of nearly six grains.

"On some peculiarities of Fœtal Digestion." By George Robinson, M.D. Communicated by William Bowman, Esq., F.R.S.

The author endeavours to show, contrary to the assertions of Dr. Robert Lee, that the human fœtus, in common with that of all the higher animals, invariably contains, during the latter periods of intra-uterine life, albuminous or nutritious matter, which undergoes digestion in the small intestines. He finds that the nature of this substance varies very much in different animals. In the earlier periods of fœtal life, the stomach contains very little, if any, nutritious matter. He is disposed to consider the salivary glands as the source of the albuminous matter found in the stomach at later periods.

"Extracts of Letters from Captain Williams, first Assistant to the Commissioner of Arracan, and from Ensign Haukeu and Mr. Howe, Marine Assistant Commissioner, giving details of a curious phenomenon seen at sea off Ryook Phyoo." Communicated by Viscount Mahon, F.R.S., Pres. S.A.

The appearance in question, seen between five and six o'clock in the evening of the 2nd of December 1845, was that of a large flame far out at sea, flickering several times for fifteen and twenty minutes, and suddenly ceasing. It was conjectured to have been either a large ship on fire, or a volcanic eruption; but no positive data exist for determining the question.

"On the Fossil Remains of the soft parts of Foraminifera discovered in the Chalk and Flint of the South-east of England." By Gideon Algernon Mantell, Esq., LL.D., F.R.S.

By subjecting small portions of calcareous rock to the action of diluted hydrochloric acid, the calcareous earth and the shells it had enveloped were removed; the residue consisting of particles of quartz and of green silicate of iron; and also numerous remains of the soft parts of animalcules, chiefly Xanthidia and Rotaliæ. The organization of the latter appears, from the observations of Ehrenberg, to be very simple, and to have no relation with the Cephalopoda, as was formerly imagined. The body is enclosed within the shell, which is polythalamous, and it occupies not only the outer chamber, but also all the cells contemporaneously, and the shell is pierced all over with minute pores, through which tentacula protrude; and there are also several soft transparent feelers, or *pseudopodia,* which are instruments of locomotion. When the shell is removed by acid, the soft body is exposed, and is seen to extend to the innermost chamber; and there is a connecting tube occupying the place of the siphuncle of the nautilus, but which is the intestinal canal; for the cells are the receptacles of the digestive sacs or stomachs, in which monads, naviculæ, and other minute infusoria, which the animal had swallowed, may sometimes be observed. In the fossil remains, the appearance of the parts which the author supposes to be the digestive organs, is that of a series of bladders or sacs, composed of a tough flexible integument, and connected by a tube. These organs are more or less filled with a dark substance; those which are distended are always well-defined, while the empty ones are collapsed and disposed in folds, just as membranous pouches would appear under similar conditions. The sacs regularly diminish in size from the outer to the innermost cell, and vary in number from fourteen to twenty-six. In some instances, small papillæ are observable on the external surface of the integument, which are probably vestiges of the bases of the pseudopodia or tentacula.

Drawings of the various specimens described by the author accompany the paper.

"Microscopic Observations on the so-called Vesicular Vapours of Water as existing in the Vapours of Steam, and in Clouds," &c. By A. Waller, M.D. Communicated by P. M. Roget, M.D., Sec. R.S.

From some experiments, of which the author published an account in the Philosophical Magazine of last February, he was led to conclude that the opaque vapours of condensed steam consist of minute globules or spherules of water, and not of small vesicles, as is implied in the generally received theory, according to which this condition of water is designated by the term *vesicular vapour*. In the present paper, he relates a set of experiments confirming by microscopic observation his views of the globular condition of the particles of opaque vapours; premising a short retrospect of the opinions of Sir Isaac Newton, Halley, Kratzenstein, and De Saussure on this subject. Finding it impossible to observe the globules with any high magnifying power while they are at liberty to move, the author adopted the plan of fixing the condensed vapours arising from the breath or other sources, in some liquid, such as oil, which has no affinity with water. Of the many vehicles which he has tried, he finds Canada balsam to be that which is best adapted for these observations. By breathing with a little force on a slip of glass previously covered with a thin layer of balsam, the vapours of the breath are not only condensed on its surface, but penetrate beneath, where they may be recognised in opaque streaks of a white colour, and where they remain stationary for more than an hour; or, if covered with another thin piece of glass or talc, for a much longer period. These streaks are decomposed under the microscope into minute globules perfectly spherical, like shot, or the globules of mercury. The author describes, at some length, the various appearances presented under different circumstances, and with different oily fluids; and gives drawings of these appearances as exhibited by the microscope.

"Experiments relative to Animal Temperature, showing that there must be some source of animal heat besides the combustion of the Carbon and the Hydrogen contained in the Food of Animals." By Robert Rigg, Esq., F.R.S.

The subject of these experiments was a labouring man in the employment of the author, living on his ordinary food, and working at his usual employment. A strict examination was instituted into the quantity and chemical constituents of the ingesta and egesta during ten days; at the end of which time he had gained one pound in weight. He infers from the results of this experiment, that the carbon and hydrogen contained in the food of animals, which enter into combination with the respired oxygen, forming carbonic acid and water, do not generate sufficient heat for the purposes of animal life; and that consequently there must be some other sources of heat in the animal economy, one of which he believes to be the secretion of carbon.

"Electro-Physiological Researches.—Fourth Memoir. On the Physiological Action of the Electric Current." By Charles Matteucci. Communicated by Michael Faraday, Esq., LL.D., F.R.S.

In the prosecution of his inquiries on the physiological action of electric currents, the author found it necessary to employ an apparatus, which was expressly made for him by M. Bréguet, adapted to the delicate appreciation of the intensity of the force of the muscular contractions excited by those currents; of which apparatus he gives a minute description, illustrated by a drawing. He was thus enabled to institute an exact comparison between the contractions caused by the direct, and those by the reverse currents, both at the commencement and at the termination of their action. The following are the general conclusions he deduces from the experiments thus conducted.

1. The passage of the electric current through a mixed nerve produces a variation in the excitability of the nerve, differing essentially in degree, according to the direction of the current through the nerve. This excitability is weakened and ultimately destroyed; and this takes place more or less rapidly according as the *direct current*, that is, a current circulating through the nerve from the centre to the periphery, is more or less intense. On the other hand, by the passage of the same current in the contrary direction, that is, from the periphery to the centre, or the *inverse current*, the excitability is preserved and increased.

2. The variations in the excitability of the nerve produced by the passage of the current, tend to disappear more or less rapidly on the current ceasing. If the nerve be taken from a living animal, or from one in which life is but just extinct, so that its excitability is very great, these variations last only as long as the current continues to circulate; while, if the nerve has already lost some of its excitability, they survive the cessation of the current by a period of from one to ten or fifteen seconds.

3. If the same current be made to act upon a mixed nerve, the contraction which occurs on the first moment of its introduction is very different according to its direction; the direct current always occasioning a stronger contraction than that produced by the inverse current.

"On Phlogiston and the Decomposition of Water." By W. F. Stevenson, Esq., F.R.S.

The author is of opinion that the evidence on which the modern theory of the composition of water is founded, is fallacious; and believing water to be a simple body, he conceives that it forms hydrogen by combining with the electric fluid, which he imagines to be identical with the phlogiston of former chemists. He cites the opinions of Priestley, Cavendish and Watt, as corroborating his views, and interprets their experiments in conformity with the hypothesis he has adopted.

"Suggestion intended to confirm Franklin's Theory of Electrostatics, by explaining the phenomena of Repulsion between bodies negatively electric." By James A. Smith, Esq. Communicated by S. Hunter Christie, Esq., Sec. R.S., &c.

The author conceives that in negatively electrified bodies, or bodies having less than their natural quantity of electricity, the redundant matter must have a tendency to escape, and thus the equilibrium of its cohesion is destroyed; and that two bodies in such a condition must mutually repel each other.

"On Sir Isaac Newton's Method of finding the Limits of the Roots of Equations." By Herbert Panmure Ribton, Esq. Communicated by John George Children, Esq., F.R.S.

The author states that he has reason to believe that by generalizing from successive inductions of equations, a formula more universal than Newton's Binomial could be found.

"Description of a Method of Registering Magnetic Variations." By Charles Brooke, Esq., M.B. Communicated by G. B. Airy, Esq., F.R.S.

A vertical stream of light issuing through a slit in the copper tube of a camphine lamp, is reflected by a concave mirror fixed vertically on the axis of a suspended magnet, and condensed into a focus by a cylindrical lens placed at the distance of about seven feet from the mirror. The luminous image, which shifts its position according to the movements of the magnet, but to a much greater extent, impinges on highly sensitive photographic paper, wound round a horizontal cylinder, which is made, by a watch movement, to revolve once in twelve hours. Thus, by a combination of the vertical movement of the paper with the horizontal movement of the image, the magnetic curve of variation is distinctly portrayed and registered.